

**Amendments to the Claims:**

This listing of claims will replace all prior versions, and listings, of claims in the application:

**Listing of Claims:**

**Claims 1-11 (Cancelled)**

1           **Claim 12 (Currently amended):** An acceleration sensor  
2       for detecting an acceleration caused by an object  
3       oscillated in an oscillation direction, comprising:

4           a sensor casing having a center axis and to be  
5       positioned in coaxial alignment with said oscillation  
6       direction to receive said acceleration, said sensor casing  
7       including a cylindrical fixed case member having a  
8       supporting portion axially extending, and a cover assembly  
9       provided on said fixed case member to cover said fixed case  
10      member to define a closed space;

11           an oscillation plate accommodated in said closed space  
12      of said sensor casing and having a central portion  
13      supported by said supporting portion of said fixed case  
14      member, and a peripheral portion integrally formed with  
15      said central portion and extending radially outwardly of  
16      said central portion to be freely movable with respect to  
17      said supporting portion of said fixed case member, said  
18      oscillation plate being partly oscillatable along said  
19      center axis with respect to said fixed case member;

20           a piezoelectric element held in contact with said  
21      oscillation plate to generate a voltage indicative of said  
22      acceleration when said acceleration is exerted on said  
23      sensor casing to have said oscillation plate partly  
24      oscillated along said center axis with respect to said  
25      sensor casing with said peripheral portion of said

26 oscillation plate being deformed, said piezoelectric  
27 element having first and second electrodes having said  
28 voltage indicative of said acceleration to output  
29 therethrough, and said oscillation plate and said  
30 piezoelectric element being integrally oscillatable within  
31 a range of effective oscillation frequencies; and

32 at least one terminal pin extending through said cover  
33 assembly and terminating at an ~~the~~ exterior of said cover  
34 assembly, said terminal pin electrically connected with one  
35 of said electrodes;

36 whereby said oscillation plate and said piezoelectric  
37 element are integrally oscillatable in two different modes  
38 consisting of: a first oscillation mode where said  
39 oscillation plate is irregularly deformed to have said  
40 peripheral portion oscillated with a single vector in said  
41 oscillation direction of said oscillation plate when said  
42 oscillation plate is oscillated with respect to said fixed  
43 case member at a resonance frequency  $f_0$ ; and a second  
44 oscillation mode where said oscillation plate is  
45 irregularly deformed to have two different half parts of  
46 said peripheral portion oscillated with ~~their~~ respective  
47 different vectors opposite to each other in said  
48 oscillation direction of said oscillation plate when said  
49 oscillation plate is oscillated with respect to said fixed  
50 case member at a noise frequency  $f_{01}$ , and said resonance  
51 frequency  $f_0$  and said noise frequency  $f_{01}$  are out of said  
52 range of effective oscillation frequencies.

1 **Claim 13 (Currently amended):** An acceleration sensor  
2 for detecting an acceleration as set forth in claim 12, in  
3 which said supporting portion of said fixed case member has  
4 a cylindrical section and a forward tapered section  
5 integrally formed with said cylindrical section and in the  
6 form of a truncated cone shape, said

7 forward tapered section having a top surface securely held  
8 in contact with a surface ~~said second surface~~ of said  
9 oscillation plate and having an outer end edge in axially  
10 alignment with an ~~the~~ outer peripheral end of said  
11 peripheral portion of said oscillation plate, said outer  
12 end edge having a diameter  $\phi C_1$  (mm), and said oscillation  
13 plate having an effective oscillation radius  $R_1$  (mm)  
14 measured between ~~the~~ inner and outer ends of said  
15 peripheral portion of said oscillation plate;

16 whereby said oscillation plate and said piezoelectric  
17 element are integrally oscillatable in said first and  
18 second oscillation modes ~~models~~ with  $\phi C_1$  (mm) /  $R_1$  (mm) and  
19  $f_{01} / f_0$  given in the following equations.

20 
$$\phi C_1 \text{ (mm)} / R_1 \text{ (mm)} \geq 0.92 \text{ and } f_{01} / f_0 \geq 0.52$$

1 **Claim 14 (Currently amended):** An acceleration sensor  
2 for detecting an acceleration as set forth in claim 12 or  
3 claim 13, in which said fixed case member and said  
4 oscillation plate are each made of an electroconductive  
5 material to ensure that ~~the remaining~~ one of said  
6 electrodes is electrically connected with said oscillation  
7 plate and said fixed case member.

1 **Claim 15 (Currently amended):** An acceleration sensor  
2 for detecting an acceleration caused by an object  
3 oscillated in an oscillation direction, comprising:

4 a sensor casing having a center axis and to be  
5 positioned in coaxial alignment with said oscillation  
6 direction to receive said acceleration, said sensor casing  
7 including a cylindrical fixed case member having a  
8 supporting portion axially extending, and a cover assembly  
9 provided on said fixed case member to cover said fixed case  
10 member to define a closed space;

11 an oscillation plate accommodated in said closed space

12 of said sensor casing and having a central portion  
13 supported by said supporting portion of said fixed case  
14 member, and a peripheral portion integrally formed with  
15 said central portion and extending radially outwardly of  
16 said central portion to be freely movable with respect to  
17 said supporting portion of said fixed case member, said  
18 oscillation plate being partly oscillatable along said  
19 center axis with respect to said fixed case member, said  
20 oscillation plate having a first flat surface opposing and  
21 spaced apart along said center axis with respect to said  
22 fixed case member, and a second flat surface opposing and  
23 spaced apart along said center axis with respect to said  
24 cover assembly of said sensor casing;

25 a first piezoelectric element having a first surface  
26 and a second surface, said first surface of said first  
27 piezoelectric element held in contact with said second flat  
28 surface of said oscillation plate to generate a voltage  
29 indicative of said acceleration when said acceleration is  
30 exerted on said sensor casing to have said oscillation  
31 plate partly oscillated along said center axis with respect  
32 to said sensor casing with said peripheral portion of said  
33 oscillation plate being deformed;

34 a second piezoelectric element having a first surface  
35 and a second surface, said first surface of said second  
36 piezoelectric element held in contact with said first flat  
37 surface of said oscillation plate to generate a voltage  
38 indicative of said acceleration when said acceleration is  
39 exerted on said sensor casing to have said oscillation  
40 plate partly oscillated along said center axis with respect  
41 to said sensor casing with said peripheral portion of said  
42 oscillation plate being deformed, said first and second  
43 piezoelectric elements each having a plurality of  
44 electrodes having said voltage indicative of said  
45 acceleration to output therethrough, said electrodes

46 including a first electrode provided on said second surface  
47 of said first piezoelectric element, and a second electrode  
48 provided on said second surface of said second  
49 piezoelectric element, ~~and a second electrode provided on~~  
50 ~~said second surface of said second piezoelectric element,~~  
51 and said oscillation plate and said first and second  
52 piezoelectric elements being integrally oscillatable within  
53 a range of effective oscillation frequencies; and

54 at least one terminal pin extending through said cover  
55 assembly and terminating at an ~~the~~ exterior of said cover  
56 assembly, said terminal pin electrically connected with  
57 said first and second electrodes;

58 whereby said oscillation plate and said first and  
59 second piezoelectric elements are integrally oscillatable  
60 in two different modes consisting of: a first oscillation  
61 mode where said oscillation plate is irregularly deformed  
62 to have said peripheral portion oscillated with a single  
63 vector in said oscillation direction of said oscillation  
64 plate when said oscillation plate is oscillated with  
65 respect to said fixed case member at a resonance frequency  
66  $f_0$ ; and a second oscillation mode where said oscillation  
67 plate is irregularly deformed to have two different half  
68 parts of said peripheral portion oscillated with ~~their~~  
69 respective different vectors opposite to each other in said  
70 oscillation direction of said oscillation plate when said  
71 oscillation plate is oscillated with respect to said fixed  
72 case member at a noise frequency  $f_{01}$ , and said resonance  
73 frequency  $f_0$  and said noise frequency  $f_{01}$  are out of said  
74 range of effective oscillation frequencies.

1 **Claim 16 (Currently amended):** An acceleration sensor  
2 for detecting an acceleration as set forth in claim 15, in  
3 which said supporting portion of said fixed case member has  
4 a cylindrical section and a forward tapered section

5 integrally formed with said cylindrical section and in the  
6 form of a truncated cone shape, said  
7 forward tapered section having a top surface securely held  
8 in contact with said second surface of said oscillation  
9 plate and having an outer end edge in axially alignment  
10 with ~~an~~ the outer peripheral end of said peripheral portion  
11 of said oscillation plate, said outer end edge having a  
12 diameter  $\phi C_1$  (mm), and said oscillation plate having an  
13 effective oscillation radius  $R_1$  (mm) measured between the  
14 inner and outer ends of said peripheral portion of said  
15 oscillation plate;

16 whereby said oscillation plate and said first and  
17 second piezoelectric element are integrally oscillatable in  
18 said first and second oscillation modes with  $\phi C_1$  (mm) /  $R_1$   
19 (mm) and  $f_{01} / f_0$  given in the following equations.

20 
$$\phi C_1 \text{ (mm)} / R_1 \text{ (mm)} \geq 0.92 \text{ and } f_{01} / f_0 \geq 0.52$$

1 **Claim 17 (Currently amended):** An acceleration sensor  
2 for detecting an acceleration as set forth in any one of  
3 claims 15 and 16, ~~further comprising in which said first~~  
4 ~~piezoelectric element having~~ a third electrode provided on  
5 said first surface of said first piezoelectric element, and  
6 ~~second piezoelectric element having~~ a fourth electrode  
7 provided on said ~~first~~ second surface of said ~~second~~ first  
8 piezoelectric element, and said fixed case member and said  
9 oscillation plate are each made of an electroconductive  
10 material and to ensure that said third electrode of first  
11 piezoelectric element and said fourth electrode of said  
12 second piezoelectric element are electrically connected  
13 with said oscillation plate and said fixed case member.